An Update on the Risks of CO₂ Injection and Value of Enhanced Oil Recovery (in Texas)

Presented by: Richard Bost, P.E., P.G. (Texas)

I2M Associates
Co-Authors and Acknowledgements

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Enhanced Oil Recovery Via $\text{CO}_2$ Injection
Before Recent Shale Oil Increase, CO2 EOR had a major impact on US Oil Production
Preparation of Well for CO2 Injection

Source: Kari Suedel, EERD Staff Photographer and Janet Crossland
Primary Risks of CO$_2$ Injection

- Price is currently low; may increase if tax put on all CO$_2$
- Sequestration Risk: Acid Gas (often disposed of with H$_2$S) can escape through old wells not properly cemented
- Operational Risk: Acid Gas repairs production/injection tubing and material upgrades; short circuiting in subsurface injection zone; potential loss via faults
- Primary Business Risk: Availability and price of CO$_2$
ARI Estimate of Value of CO$_2$ EOR Projects

<table>
<thead>
<tr>
<th>Revenue Recipient</th>
<th>Value Chain Function</th>
<th>Revenues per Barrel ($)</th>
<th>Total* (Billions of $)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power/industrial companies</td>
<td>Sale of captured CO$_2$ emissions</td>
<td>$13.20</td>
<td>$1,320</td>
</tr>
<tr>
<td>Federal/state treasuries</td>
<td>Severance/income taxes</td>
<td>$19.80</td>
<td>$1,980</td>
</tr>
<tr>
<td>U.S. economy</td>
<td>Services, materials and sales</td>
<td>$26.50</td>
<td>$2,650</td>
</tr>
<tr>
<td>Other</td>
<td>Private mineral rights</td>
<td>$7.70</td>
<td>$770</td>
</tr>
<tr>
<td>Oil and gas industry</td>
<td>Return of/on capital</td>
<td>$17.80</td>
<td>$1,780</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$85.00</td>
<td>$8,500</td>
</tr>
</tbody>
</table>
Supply of CO₂ is Limiting Expansion of EOR, Why?
Why Limited Supply

- Natural/Industrial Supply controlled by limited number of players
- Supply committed to a limited number of energy companies
- Natural supply plentiful; industrial power industry source plentiful but uncertainty in whether power plants will close sooner than represented
- Supply requires pipeline transportation, so deals involve long term commitments by larger players
- Current shale oil & gas market is cheap; business incentives increase with price of oil
- Lack of governmental support for commercial pipelines and open market for CO₂
- No current regulatory limits on industrial emissions of CO₂
Current Supplier and EOR Locations and Transporters
Kinder Morgan major player in CO2 Enhanced Oil Recovery; Oxy Primary User
Conclusions

- Considerable regulatory, economic, business and operational uncertainties have created risks limiting expansion of the beneficial use of CO$_2$ injection for EOR.

- Environmentalists are generally opposed to any activity that supports Oil & Gas production, even if beneficial to the environment.

- Working together rather than litigating yields better results: author has supported successful Stakeholders groups permitting resolutions.